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ABSTRACT

This project attempts to determine the reasons for significant fluctuations in enrollment in four basic science courses for non-science majors, and to assess the needs of non-science students at Illinois Central College. A study of enrollment changes indicates a drop in enrollment in two courses, little change in one course, and an increase in a fourth course. A questionnaire/survey was developed to assess expectations of students enrolled in the four courses and actual experiences at the completion of the courses. Counselors were asked to complete a questionnaire rating students' reasons for selecting a particular course. Results of the survey indicate the following: (1) students often enroll in the course perceived to be the easiest option for satisfying their lab science requirement; (2) students find the laboratories impractical and not closely related to course content; (3) classroom experience is viewed by students in terms of learning facts rather than the processes of science; and (4) the science attitude of students does not change significantly during the course. The major product of the research is the development of survey instruments which can be used to improve courses and make them compatible with student needs. (Author)

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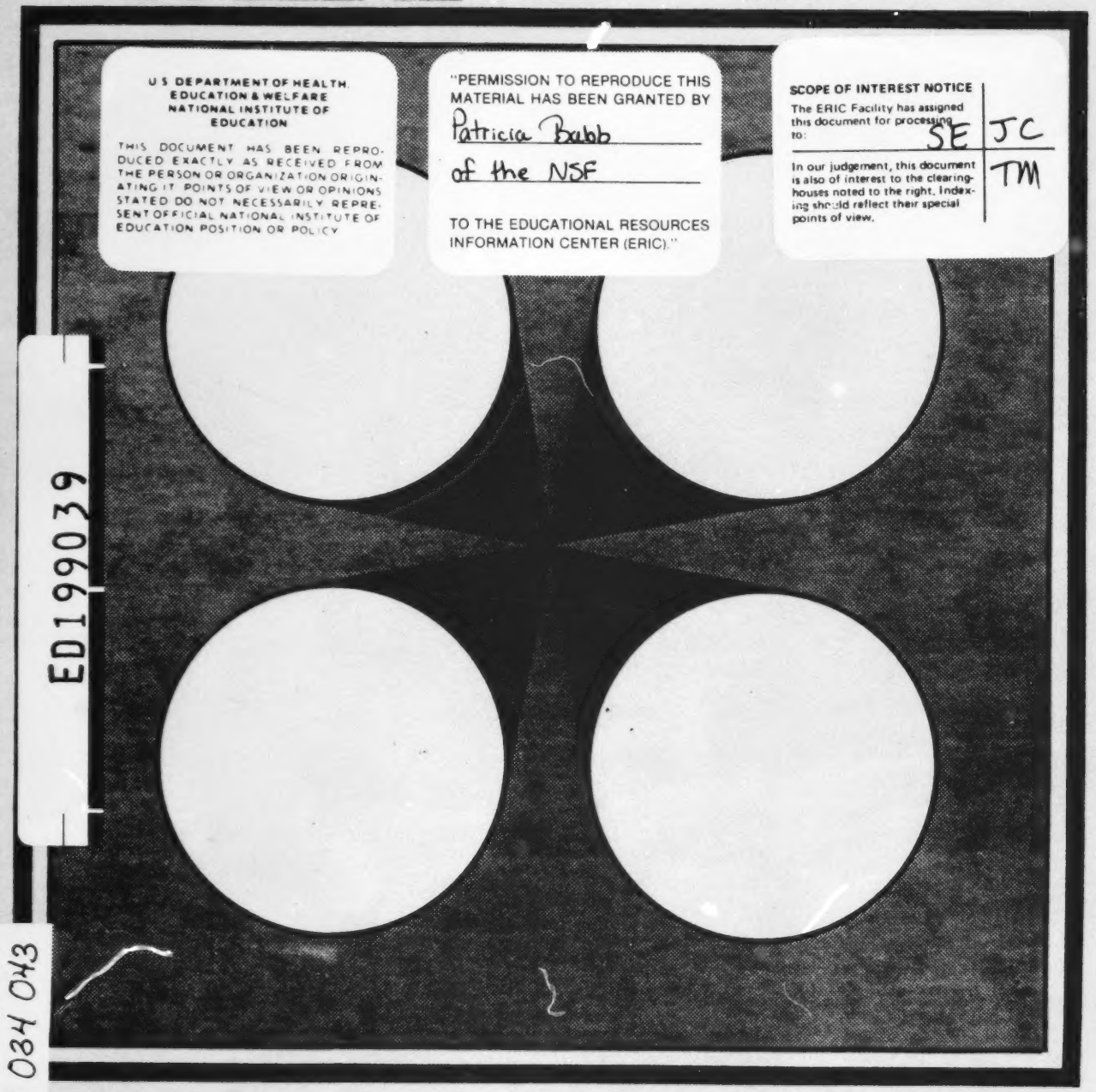
LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE

Science for the Non-Science Student at Illinois Central College:

"An Assessment of Science Needs for Community College Students"

1979



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78-09672

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Thomas Campbell

I. ABSTRACT

Recent enrollment fluctuations at Illinois Central College has prompted faculty and administrative concern.

This project was completed in an effort to determine the nature of changes which occurred in the four basic science courses for non-science majors; Physical Science 110, Earth Science 111, Biology 112, and Biology 114.

A study of enrollment changes over the past four (4) years illustrated a significant change in three of these courses. While Physical Science 110 and Biology 114 enrollments have dropped considerably, Earth Science 111 enrollments have increased in proportion to the overall enrollment of the College. Biology 112 enrollments have not changed significantly.

To determine possible reasons for these changes, a three-fold questionnaire/survey was developed. Students enrolled in these four (4) selected courses were asked a series of questions at the beginning and at the end of their experience. Questions centered on their "expectations" before the course began and their "actual experience" following the course. In addition, College counselors were asked to complete a questionnaire rating students' reasons for choosing a science course. These rankings were compared to the rankings students made of the same possible reasons.

At the conclusion of the project, several significant findings suggested how science courses could be improved to better meet the needs (and initial perceptions) of students. Most notable are:

1. Students need additional access to faculty after class hours for assistance with course content.

2. Many Physical Science/Earth Science students enroll in these courses rather than Biology because of an interest in the subject.

3. Many Biology students enroll in Biology courses because of past experience in Biology.

4. Students find science laboratories impractical and not closely related to course content.

5. Many Earth Science 111 students perceive this course to be the easiest option for satisfying their lab science requirement.

6. Most science students see their classroom experience as fact attainment rather than learning about the processes of science.

7. The science attitude of students enrolled in these classes does not change significantly over the period of one semester.

The major product of this project has been the development of several survey instruments which can be utilized to determine how well beginning science classes meet the perceived needs of students. Hopefully, these instruments will be utilized in a continuous fashion over the next few years to monitor changes in students' reactions to changes made in these courses by our science faculty.

Thomas C. Campbell
Project Director
Illinois Central College

II. OBJECTIVES

Illinois Central College is a large comprehensive community college serving a large district in central Illinois. The three major thrusts of the institution are: Liberal Arts Education, Career Education, and Continuing Education. This project centered on transfer courses taught in the Liberal Arts Division mainly for non-science majors intending to transfer to a senior institution.

In the past several years, the enrollment in the basic non-science courses has changed dramatically. Since these courses are basic to the LAS offering and selection of these courses by students for satisfying transfer degree requirements are dependent on many factors, the major object of this project was to investigate the nature of enrollment changes in the non-science courses. Specifically, the objectives were:

(Describing the problem)

1. Answer a series of questions concerning the enrollment of the non-science majors at a community college:

   a. What courses are non-science majors selecting to satisfy their laboratory requirements?

   b. How has the distribution of non-science students changed in the past five (5) years?

   c. Who or what has been the major factor influencing the non-science student to enroll in a science course?

(Reasons for the problem)

2. Create a general questionnaire to be administered to each non-science student enrolled in a science course. The purpose of this questionnaire would be to describe each student's perception of the course and how it is or is not meeting his needs. This assessment should include the appropriateness of:

   a. Course content.

   b. Instructional methodology.

   c. Laboratory design.

   d. Course requirements.

III. METHODS

A. Objective 1

The four primary courses taken by the non-science major at Illinois Central College are Physical Science 110, Earth Science 111, Biology 112 and Biology 114. The first part of this study was to research past enrollment figures since 1974 to compare trends. These figures are displayed in Appendix I.

Although Biology 112 and Earth Science 111 show a strong enrollment trend over the years shown, Physical Science 110 and Biology 114 show declines. One wonders about this pattern especially in view of the fact that strong declines in both of these basic science courses began in 1976-77, while Earth Science 111 and Biology 112 remained about the same or increased slightly.

These figures definitely show a preference by the non-science major for Earth Science 111 and Biology 112. One cannot reach the conclusion that Biology is preferred over Physical Science, thus, the change in enrollment must be due to other factors; e.g., reputation of the courses, perception of the course content/requirements, or influence of others on the student choice.

B. Objective 2

Students who enroll in a non-science class do so for a variety of reasons and intents. One of the primary or basic reasons is to satisfy a degree requirement of laboratory science. To further investigate these reasons and to determine the perception of these enrolling students, a basic pre/post questionnaire procedure was adopted. A third instrument was developed for student counselors and was given at the close of the semester.

The instruments developed are displayed in the Appendix. These are:

Appendix II - Science Survey (Initial)
Appendix III - Science Survey (Final)
Appendix IV - Science Needs Survey
Questionnaire for Student Counselors

During the Fall Semester of 1978, these instruments were used to collect data from a total of 179 students; 37 enrolled in Physical Science 110, 84 enrolled in Earth Science 111, 24 enrolled in Biology 112 and 34 enrolled in Biology 114. In addition, seven ICC counselors responded via the needs survey for student counselors.

The Initial Science Survey was given at the start of the semester. Questions ask students for their reasons for taking the class and for their expectations. Also included were a series of questions which tapped their general attitude toward science.

The Final Science Survey was given at the close of the semester. Questions dealing with reasons for enrolling were deleted and questions from the Initial Questionnaire dealing with expectations were phrased to ask about what actually happened to the student during the semester. For example, question 4 on the Initial Survey..."I expect this science course to be..."was replaced with..."I found this science course to be..." Appropriate choices in either case were given for students to select. This provided a mechanism to compare students "expectation" with their experience. Both questionnaires contained the same questions concerning general science attitude.

The Final Questionnaire also contained a section called "Open-Ended Questions." This allowed students to express their opinion concerning the nature of the science course and to again explain in more detail their class choice.

The Final Questionnaire was designed for college counselors. This contained a summary of the questions posed to students asking counselors to rank the order in which <u>they thought</u> students would rate the importance of each factor. The second part contained the open-ended questions correlating with those asked on the student Final Questionnaire. This afforded the opportunity to compare the counselors perceptions of students' choices with the students' reactions to the same/similar situations.

IV. RESULTS FROM THE QUESTIONNAIRES

A. Initial Science Survey

At the beginning of the Fall Semester, students in the selected science classes completed the Initial Science Survey. Results from this survey were compiled and are displayed in Appendix V. Numbers posted in each column represent % of total population responding.

1. Reasons for Enrolling

It is not surprising that the majority of students indicate "degree requirement" as a primary reason for enrolling in their science course. Both counselors and faculty academic advisors recommend students to take Physical Science 110 (47%) and Earth Science 111 (37%) while many Biology students choose these courses for themselves.

Earth Science 111 has an important edge on other courses because of its reputation with former students (question 2d) as apparently "easiest to pass" (question 3c). (These factors were also varified in the Final Student Questionnaire results given in Appendix VII).

Students rate "previous experience" as an important factor and choose Biology 112 or Biology 114 probably because of their high school background.

2. Expectations

Most students have high expectations for the required course they have selected. This expectation runs slightly higher in the two Biology courses. It is interesting to note that while enrollment in Earth Science 111 has increased dramatically over the past several years, these students tend to have lower expectations for the course than do students taking the less popular Physical Science 110. When asked about the teaching of each course, many Physcial Science 110 students (30%) expect to need help with content. Biology 112 students (27%), on the other hand, seem quite confident they can learn much of the material through self-study. This difference may again reflect the importance previous experience seems to make in being successful in each course.

Question 6 suggests that most students enter these courses expecting the instructor to be a major source of help during the semester. For some reason, Biology 112 students seem less confident in this regard. Also, most students expect to complete worthwhile laboratory exercises. This expectation was especially high among the students enrolled in Physical Science 110. This enthusiasm carried over into question 8, showing the high value students place on the information learned in these courses; especially Physical Science 110. Perhaps the small number of students who select this course are convinced it will meet their needs, otherwise, they would not have enrolled.

3. General Science Attitude

Science attitudes as assessed by the Initial Student Questionnaire were basically positive. Few significant differences between student groups were detected. One notable difference was found in response to question 10; enthusiasm for enrolling in another science class. Students taking Biology classes were more inclined to state positively that they would. Physical and Earth Science students were more undecided concerning this intention.

B. Final Science Survey

At the close of the semester, students in each science class were asked to complete the Final Science Survey displayed in Appendix III. Results from this survey are displayed in Appendix VI. The first five questions paralleled "Expectation" questions (part II) of the Initial Survey. The remaining questions (6-12) were the same as the General Science Attitude questions posed in part III of the Initial Questionnaire. Appendix VI gives the results on these comparable questions from the Initial Survey (pre) and the Final Survey (post) side-by-side.

1. Expectations/Actual Experience

Generally, most science students in the surveyed classes found their experience worthwhile. Physical Science 110 rated their experience almost exactly what they expected it to be. Students in Earth Science 111 and Biology 112 were somewhat more positive about their experience than they initially thought and Biology 114 students were the most disappointed. Biology 112 students seem to find the "self-study" expectations for the courses inappropriate.

The largest difference from pre to post was detected in items 3,4, and 5 (Initial Survey items 6, 7, and 8). In general, these results were disturbing because students rated their actual experience much lower than their expectations.

On the Initial Survey, students in all classes overwhelmingly stated that they expected to see the instructor for clarification of difficulties they experienced in the class. The Final Survey found most of them (44% composite) either asked another instructor/classmates or did the best they could on their own.

Item 4 was concerned with expected/actual experience in the science laboratory. Again, a downward trend was detected. Even though the laboratory experience was not as "practical" as expected, students in Physical Science 110 and Earth Science 111 did have "related activities." Ratings by students in the two Biology classes were more critical with a significant number of students reporting "several exercises were completed but none aided my understanding."

Finally, students rated the content of each course. Physical Science 110 students had anticipated learning "useful information" (57%), but like the experience of students in the other surveyed classes, experienced fact learning, much of which they rated as not very useful.

2. General Science Attitude

Again, only subtle changes in science attitude were found in reviewing the pre and post responses. It was, however, encouraging to note that students were more likely to take another college science course (especially Earth Science 111 and Biology 112). Also, item 13 which was added to the post assessment revealed that most students thought their science attitude improved because of the science class (composite - 60%).

3. Open-Ended Questions for Students and Counselors

The essential part of this section was a rank-ordering question which allowed students and counselors to rank three most important reasons for enrolling in a science class from a field of seven. Appendix VII shows the results for each class surveyed and their composite. A similar ranking by counselors shows how they think students will rank the items.

Again, Biology students tend to place more emphasis on "previous high school experience" with the subject. Physical and Earth Science students tend to rate "General Interest" as determining factors. Earth Science is again selected as the "easiest" whereas the other three classes are more often selected as "required by career choice." College counselors agree with the students' choices in most instances, but place a bit more emphasis on "previous high school experience" than students.

V. SUMMARY AND RECOMMENDATIONS

This project was initiated and conducted to assess the needs of beginning non-science students at Illinois Central College. Each student enters a science classroom with a preconceived notion of what it will be like and what value it will have to him academically and personally. Unfortunately, in many areas, these high expectations are not fulfilled. It is hoped that some information concerning the perception vs. experience of students will assist in making their experience more meaningful.

The list of recommendations below will act to summarize the essential parts of this project and point to some needed changes in course offerings.

Recommendations:

1. The Student Questionnaire portion of this project should be repeated for several semesters. The additional work will help validate the findings and orientate additional faculty to the problems/difficulties/strengths detected.

2. Students expect to be able to discuss difficulties with course materials with their instructor. However, most found another avenue for assistance. This inconsistency should be investigated further; e.g., is this the fault of the student or do students have difficulties in finding instructors available?

3. Counselors and academic advisors should be familiar with the basic difference between students who enroll in these type of science classes:

   Earth Science students perceive their class to be somewhat easier than the others.

   Many Physical Science and Earth Science students enroll because of an interest in the subject matter.

   Many Biology students enroll because of previous high school experience with the subject.

4. The laboratory exercises which accompany each of the non-science classes are not meeting students' expectations. Instructors in each area should assess the function of the laboratory exercises and attempt to make parts of these activities related more directly to students' experiences/ interests.

5. Students see these courses as primarily "fact learning." Faculty should re-evaluate course objectives to determine the accuracy of this perception. Perhaps some effort should be initiated to include student exercises encouraging the importance of managing or "processing" of information.

6. Students' general science attitude is not altered significantly during a semester. This may be due in part to a low emphasis of course content to the "world view." Perhaps additional emphasis should be placed on outside-the-classroom activities which assist students in making connections to larger science issues. Instructors should re-evaluate the course objectives to make this determination.

APPENDIX I

NON-SCIENCE ENROLLMENT TRENDS FOR 1974-78

APPENDIX I

Enrollment Trends for 1974-78

	1977-1978				1976-1977				1975-1976				1974-1975			
	10th Day	A-D Grades	F/ Inc	W	10th Day	A-D Grades	F/ Inc	W	10th Day	A-D Grades	F/ Inc	W	10th Day	A-D Grades	F/ Inc	W
Physical Science 110																
Fall	48	39	5	4	62	42	8	12	84	69	8	7	80	67	9	4
Spring	23	21	2	0	60	44	10	6	108	89	9	10	87	82	2	3
Summer	0	0	0	0	0	0	0	0	20	15	3	2				
Earth Science 111																
Fall	189	151	16	22	166	142	13	11	165	132	12	21	105	83	8	14
Spring	167	140	12	15	135	105	14	16	139	124	5	10	112	94	10	8
Summer	24	0	0	24	32	27	1	4	40	33	3	4				
Biology 112																
Fall	201	170	16	15	200	164	17	19	165	149	8	18	190	136	19	35
Spring	80	69	4	7	92	77	6	9	97	83	8	6	85	66	11	8
Summer	20	18	1	1	24	22	1	1	23	19	2	2				
Biology 114																
Fall	49	42	3	4	63	53	6	4	94	69	8	17	99	79	5	15
Spring	113	100	9	4	151	115	16	20	167	132	11	24	157	135	7	15
Summer	25	21	4	0	14	11	1	2	22	19	1	2				

Ledger: 10th Day - Tenth Day Class Enrollment
A-D Grades - Number of Final Class Grades (A-D)
F/Inc - Number of F's and Incomplete Grades
W - Number of Withdrawals

APPENDIX II

SCIENCE SURVEY (INITIAL)

APPENDIX II

Supported by the
National
Science
Foundation

Illinois Central College
Science Department

SCIENCE SURVEY - INITIAL

Name: _____

Social Security Number: _____

Date: _____

Course: _____

Section Number: _____

This survey has been developed by the ICC Science Department with the assistance of the National Science Foundation. Your cooperation and assistance are needed in order for ICC to evaluate its science course offerings and to provide educational science experiences which are more helpful to you and your interests. As you answer the following questions, we hope you will take this task seriously and answer each question as accurately and completely as you can. Your personal answers will be kept strickly confidential. If you need assistance with any question, please ask your instructor. You should be able to complete all the questions in about 20 minutes. THANKS IN ADVANCE FOR YOUR HELP!

Sincerely,

Tom Campbell

Thomas C. Campbell
Project Director

I have read the above paragraph and will be happy to participate in this informational project. Please consider my signature below as my permission to use my written responses in your study.

_____
Student's Signature

Science Survey

Part I: Reasons for Enrolling in this Science Course

Directions: After each of the incomplete statements found below you will find several possible completing phrases. Please choose the one which you think to be most appropriate.

1. I'm taking this science course
   a. for the general knowledge
   b. because I want to take more advanced science courses
   c. to satisfy a degree requirement
   d. because someone said I should
   e. none of the above

2. I enrolled in this course because
   a. I chose it for myself after reviewing what was offered
   b. my advisor suggested that I take it
   c. a counselor suggested that I take it
   d. another student told me about this course
   e. none of the above

3. I think that this course will be appropriate for me because
   a. I have heard that the course is excellent (good teacher, good course content,etc)
   b. I have had some previous experience with this subject matter in high school
   c. from what I hear the course requirements are the easiest to pass
   d. I'm not sure that this is the right course for me, but it was offered at a convenient time
   e. none of the above

Part II: Expectations in Taking this Science Course

Directions: Follow the directions found in Part I.

4. I expect this science course to be
   a. very interesting and informative
   b. somewhat informative
   c. almost useless for what I'm interested in
   d. a real problem--I wish there was some way I could arrange to not take science at all
   e. none of the above

5. I feel certain that the teaching in this course will make the information presented
   a. well organized and clearly understandable
   b. organized but needing clarification on many points
   c. learnable through considerable self-study and help
   d. difficult to understand and mostly useless
   e. none of the above

6. If I have difficulties with the subject matter presented in this course, I expect to
   a. see the instructor for clarification and assistance
   b. ask another instructor and/or a classmate for help
   c. do the best I can on my own
   d. drop the course
   e. none of the above

Science Survey
(continued)

7. In the laboratory portion of this course, I expect
   a. to do practical activities which are related to and will help me understand the information presented in the lecture
   b. to complete a number of exercises, some of which will be related to what is discussed in lecture
   c. to complete several exercises but none will really aid my understanding
   d. that I can get my lab partner to do most of the work
   e. none of the above

8. When I finish this course
   a. I expect to know a lot more about how the course material can benefit me at a personal level
   b. I expect to retain a large number of scientific facts which I learned in this course
   c. I will learn some facts, but these will not be useful in my academic or career pursuits
   d. the only thing I expect is a passing grade so I can complete my program requirements
   e. none of the above

Part III: General Science Attitude

Directions: Rate each of the following statements according to the way you react to what is implied in the statement. Mark your answers on the IBM answer sheet using the following rating scale:

Strongly Agree (A), Agree (B), Undecided (C), Disagree (D), Strongly Disagree (E)

9. Most people do not sufficiently appreciate the importance of science.

10. If I can fit it into my schedule, I'd like to take other science courses in college.

11. The benefits of science clearly outweigh any harm that has come from science.

12. My everyday experiences are made more meaningful through an understanding of science.

13. I usually try to take the time to watch a good science program on television.

14. There are quite a few things in science that I wish I had time to find out about.

15. I think that most of what a person learns in a science course should be related closely with his personal experience or his everyday life.

Science Survey
(continued)

Part IV: Open Ended Questions

Directions: In the spaces provided write a brief but concise response to each of the following questions:

16. What were the major factors which caused you to enroll in this science course?

17. The list of courses below are offered to ICC students who are not science majors but must satisfy program requirements.

A. Circle the course(s) which you have either completed, are now enrolled, or plan to enroll in.

B. For the remaining coures, write a brief statement telling why you do not intend to enroll in.

Biology 110 (formerly Biology 112)

Biology 111 (formerly Biology 114)

Earth Science 111

Physical Science 110

Earth Science 118

APPENDIX III

SCIENCE SURVEY (FINAL)

APPENDIX III

Supported by the
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Science
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Illinois Central College
Science Department

SCIENCE SURVEY - FINAL

Name:_____

Social Security Number:_____

Date:_____

Course:_____

Section Number:_____

As you may recall, at the beginning of this semester you completed a questionnaire much like this one concerning the science classes you have or are enrolled in. Your help has made it possible for us to study the science courses offered at ICC and how they are meeting the needs of enrolled students like yourself.

Now at the close of the semester, we are again asking some frank questions about your experience in science classes. Your honest and sincere response is of utmost importance. Please deal with each question separately and answer it as best you can from your own experience. Thanks for your help in the endeavor.

General Directions:

1. Mark your answers to questions 1-13 of Part I and Part II on the IBM answer sheet provided.

2. Write the answers to Part III (open-ended questions) in this test booklet.

Science Survey

Part I: Your Experience with this Science Course

Directions: After each of the incomplete statements found below, you will find several possible completing phrases. Please choose the one which you think to be most appropriate.

1. I found this science course to be
   a. very interesting and informative.
   b. somewhat informative.
   c. almost useless for what I'm interested in.
   d. a real problem--I wish there was some way I could arrange to not take science at all.
   e. none of the above.

2. I feel certain that the information presented in this course was
   a. well organized and clearly understandable.
   b. organized but needing clarification on many points.
   c. learnable through considerable self-study and help.
   d. difficult to understand and mostly useless.
   e. none of the above.

3. Whenever I have difficulties with the subject matter presented in this course, I
   a. asked the instructor for clarification and assistance.
   b. asked another instructor and/or a classmate for help.
   c. did the best I could on my own.
   d. considered dropping the course.
   e. none of the above.

4. In the laboratory portion of this course, I
   a. did practical activities which were related to and helped me understand the information presented in the lecture.
   b. completed a number of exercises, some of which were related to lecture discussions.
   c. completed several exercises but none really aided my understanding.
   d. could get my lab partner to do most of the work.
   e. none of the above.

5. Now that I have finished this science class
   a. I know a lot more about how the course material can benefit me at a personal level.
   b. I now know a large number of scientific facts which I learned in this course.
   c. I learned some facts, but these will not be useful in my academic or career pursuits.
   d. the only thing I got was a passing grade so I can complete my program requirements.
   e. none of the above.

Part II: General Science Attitude

Directions: Rate each of the following statements according to the way you react to what is implied in the statement. Mark your answers on the IBM answer sheet using the following rating scale:

(A) Strongly Agree (B) Agree (C) Undecided (D) Disagree (E) Strongly Disagree

6. Most people do not sufficiently appreciate the importance of science.

Science Survey
(Continued)

7. If I can fit it into my schedule, I'd like to take other science courses in college.

8. The benefits of science clearly outweigh any harm that has come from science.

9. My everyday experiences are made more meaninful through an understanding of science.

10. I usually try to take the time to watch a good science program on television.

11. There are quite a few things in science that I wish I had time to find out about.

12. I think that most of what a person learns in a science course should be related closely with his personal experience or his everyday life.

13. Because I have taken this science course, my attitude toward science has really improved.

Part III: Open Ended Question

1. When you originally selected this science class from other possible classes, you probably had some reasons for doing so. Below you will find a list of 7 possible factors which may have influenced your decision. Choose the three most influential factors and rate them 1 - most important, 2 - next important, 3 - next most important.

_____a. previous high school experience

_____b. previous college experience

_____c. this is the best of the college science classes offered

_____d. this is the easiest of the college science classes offered

_____e. I expected the other college science classes to be worse than this one

_____f. this course is required for my choice of career

_____g. I have a general interest in this subject

2. Please explain why or how you made the choice of items in question 1 above. (Use the back of this page for more writing space.)

3. A friend asks your advice concerning his enrolling in this science class. What would you tell him? (Use the back for more writing space if needed.)

APPENDIX IV

SCIENCE NEEDS SURVEY
QUESTIONNAIRE FOR STUDENT COUNSELORS

APPENDIX IV

Supported by:

The National Science Foundation

Illinois Central College

Science Needs Survey
Questionnaire for Student Counselors

Directions:

1. Read the enclosed "Science Survey" which was given to ICC students enrolled in Physical Science 110, Earth Science 111, Biology 112, and Biology 114 at the beginning of this semester.

2. Turn to the next page; "Summary of Results". Please go through each item and mark your expectations of how students would mark their answers. To do this, rank order the response choices following each question. Use 5 to indicate the highest rank and 1 to indicate the lowest. Below is an example:

1. Reasons for taking this course	Physical & Earth Science	Biology
a. for general knowledge	4	5
b. because I want to take more advanced courses	2	2
c. to satisfy a degree requirement	1	3
d. because someone said I should	3	1
e. none of the above	5	4

Please note that the first column is for Physical Science and Earth Science; the second is for Biology.

3. Finally, unite a short answer to each of the "open-ended" questions on the third page of this questionnaire.

------THANK YOU FOR YOUR ASSISTANCE------

(These results will be shared with you as soon as they are completed)

2. Summary of Results

ITEM	Physical and Earth Science	Biology 112 & 114
I. Reason for Enrolling		
1. I'm taking this science course		
a. for the general knowledge		
b. because I want to take more advanced courses		
c. to satisfy a degree requirement		
d. because someone said I should		
e. none of the above		
2. I enrolled in this course because		
a. I chose it for myself		
b. my advisor suggested		
c. a counselor suggested		
d. another student told me		
e. none of the above		
3. This course is appropriate for me because		
a. I have heard that the course is excellent		
b. I have had some previous experience		
c. easiest to pass		
d. offered at a convenient time		
e. none of the above		
II. Expectations		
4. I expect this science course to be		
a. very interesting and informative		
b. somewhat informative		
c. almost useless		
d. a real problem		
e. none of the above		
5. The teaching of this course will be		
a. well organized and clearly understandable		
b. organized and needing clarification		
c. learnable through self-study		
d. difficult to understand - useless		
e. none of the above		
6. If I have difficultuies, I expect to		
a. see the instructor		
b. ask another instructor or classmate		
c. do the best I can on my own		
d. drop the course		
e. none of the above		
7. In the laboratory, I expect		
a. to do practical activities (all related)		
b. to complete a number of related exercises		
c. to do exercises/none to help understanding		
d. lab partner will do work		
e. none of the above		
8. When I finish this course		
a. I expect to know a lot more		
b. I expect to retain facts		
c. I will learn some facts (not useful)		
d. I expect a passing grade		
e. none of the above		

3. Open-Ended-Questions

A. When non-science students select science classes, there are probably a number of factors which they consider. Below are seven (7) possibilities. Please choose the three factors which you think influence students the most. Rate these factors as: 1 - most important, 2 - next important, 3 - next most important.

_____1. previous high school experience

_____2. previous college experience

_____3. this is the best of the college science classes offered

_____4. this is the easiest of the college science classes offered

_____5. I expected the other college science classes to be worse than this one

_____6. this course is required for my choice of career

_____7. I have a general interest in this subject

B. Please explain how or why you made the choice of items above.

C. When a student needs advice for a science requirement and Biology 112 and Biology 114 are both possibilities, in which order do you suggest they be taken and why?

D. Under what circumstances do you advise non-health occupations students to enroll in Anatomy and Physiology 140?

E. Which do you believe is the easiest course for an average ability non-science student to complete; Physical Science 110 or Earth Science 111? Elaborate please.

APPENDIX V

RESULTS OF INITIAL STUDENT QUESTIONNAIRE

APPENDIX V

Results of Initial Student Questionnaire

ITEM	Physical Science 110	Earth Science 111	Biology 112	Biology 114	Composite
	%	%	%	%	%
I. Reasons for Enrolling					
1. I'm taking this science course					
a. for the general knowledge	15	15	16	17	16
b. because I want to take more advanced courses	2	2	10	6	4
c. to satisfy a degree requirement	81	76	68	71	75
d. because someone said I should	0	7	3	3	4
e. none of the above	2	0	3	3	1
2. I enrolled in this course because					
a. I chose it for myself	38	40	39	63	43
b. my advisor suggested	15	22	16	6	17
c. a counselor suggested	32	15	29	6	20
d. another student told me	4	18	0	14	11
e. none of the above	11	5	16	11	9
3. This course is appropriate for me because					
a. I have heard that the course is excellent	19	23	3	17	18
b. I have had some previous experience	30	24	55	51	35
c. easiest to pass	4	21	0	3	11
d. offered at a convenient time	9	3	16	6	7
e. none of the above	38	29	26	23	29
II. Expectations					
4. I expect this science course to be					
a. very interesting and informative	53	39	51	65	48
b. somewhat informative	36	46	23	20	36
c. almost useless	4	9	10	12	8
d. a real problem	3	5	6	3	5
e. none of the above	4	1	10	0	3
5. The teaching in this course will be					
a. well organized and clearly understandable	53	66	50	71	62
b. organized but needing clarification	30	20	17	17	21
c. learnable through self-study	11	8	27	6	11
d. difficult to understand - useless	2	0	3	0	1
e. none of the above	4	6	3	6	5

ITEM	Physical Science 110	Earth Science 111	Biology 112	Biology 114	Composite
	%	%	%	%	%
6. If I have difficulties, I expect to					
a. see the instructor	89	93	71	85	87
b. ask another instructor or classmate	9	3	10	3	5
c. do the best I can on my own	2	3	16	6	5
d. drop the course	0	0	0	0	0
e. none of the above	0	1	3	6	3
7. In the laboratory, I expect					
a. to do practical activities (all related)	81	69	65	63	70
b. to complete a number of related exercises	19	28	29	31	26
c. to do exercises/none to help understanding	0	0	0	0	0
d. lab partner will do work	0	0	0	3	1
e. none of the above	0	3	6	3	3
8. When I finish this course					
a. I expect to know a lot more	57	36	32	45	42
b. I expect to retain facts	23	21	35	20	24
c. I will learn some facts (not useful)	17	32	19	26	25
d. I expect a passing grade	0	4	7	5	4
e. none of the above	3	7	7	3	5
III. General Science Attitude					
9. Most people do not sufficiently appreciate the importance of science.					
a. strongly agree	19	16	23	17	18
b. agree	55	63	64	57	60
c. undecided	23	15	13	20	18
d. disagree	3	6	0	3	3
e. strongly disagree	0	0	0	3	1
10. If I can fit it into my schedule, I'd like to take another science class.					
a. strongly agree	6	8	19	14	10
b. agree	26	19	35	26	24
c. undecided	49	52	23	40	45
d. disagree	15	14	13	11	14
e. strongly disagree	4	7	10	9	7
11. The benefits of science clearly outweigh any harm caused.					
a. strongly agree	28	21	43	41	29
b. agree	32	43	23	35	36
c. undecided	38	27	27	15	28
d. disagree	2	9	7	6	6
e. strongly disagree	0	0	0	3	1

ITEM	Physical Science 110	Earth Science 111	Biology 112	Biology 114	Composite
	%	%	%	%	%
12. My everyday experiences are made more meaningful through science.					
a. strongly agree	15	14	35	9	17
b. agree	53	39	26	50	42
c. undecided	24	34	19	17	27
d. disagree	6	11	10	21	11
e. strongly disagree	2	2	10	3	3
13. I usually try to take the time to watch a good science TV show.					
a. strongly agree	8	10	23	17	13
b. agree	28	27	16	26	25
c. undecided	15	24	23	17	21
d. disagree	43	28	19	23	29
e. strongly disagree	6	11	19	17	12
14. There are quite a few things in science that I wish I could find out about.					
a. strongly agree	30	29	39	29	31
b. agree	49	44	39	38	43
c. undecided	19	17	10	27	18
d. disagree	2	10	12	3	7
e. strongly disagree	0	0	0	3	1
15. I think that most of science should relate to personal experience.					
a. strongly agree	30	25	29	14	25
b. agree	47	39	42	46	43
c. undecided	19	21	19	23	21
d. disagree	4	14	7	14	10
e. strongly disagree	0	1	3	3	1

APPENDIX VI

STUDENT QUESTIONNAIRE PRE-POST COMPARISON

APPENDIX VI

Student Questionnaire

Pre-Post Comparison

ITEM	Physical Science 110 (n=37) Pre	Physical Science 110 (n=37) Post	Earth Science 111 (n=84) Pre	Earth Science 111 (n=84) Post	Biology 112 (n=24) Pre	Biology 112 (n=24) Post	Biology 114 (n=34) Pre	Biology 114 (n=34) Post	Composite (n=179) Pre	Composite (n=179) Post
	%		%		%		%		%	
1. I expected/found this science course to be:										
a. very interesting & informative	53	54	39	65	51	75	65	49	48	61
b. somewhat informative	36	43	46	21	23	25	20	42	36	30
c. almost useless	4	0	9	6	10	0	12	9	8	5
d. a real problem	3	0	5	6	6	0	3	0	5	3
e. none of the above	4	3	1	1	10	0	0	0	3	1
2. I feel certain that the information presented will be/was:										
a. well organized & clearly understandable	53	59	66	75	50	58	71	67	62	68
b. organized but needing clarification	30	21	20	11	17	38	17	24	21	19
c. learnable through self study	11	14	8	10	27	4	6	3	11	8
d. difficult/almost useless	2	3	0	1	3	0	0	3	1	2
e. none of the above	4	3	6	3	3	0	6	3	5	3
3. Whenever I have/had difficulties, I:										
a. asked the instructor	89	49	93	38	71	33	85	70	87	46
b. asked another instructor of classmate	9	8	3	17	10	17	3	9	5	13
c. did the best I could on my own	2	43	3	31	16	42	6	12	5	31
d. considered dropping the course	0	0	0	1	0	0	0	0	0	1
e. none of the above	0	0	1	13	3	8	6	9	3	9
4. In the laboratory, I expect/did have:										
a. practical activities	81	54	69	51	65	33	63	49	70	49
b. related activities	19	32	28	41	29	33	31	30	26	36
c. several exercises/none aided my understanding	0	8	0	7	0	25	0	15	0	11
d. my lab partner do the work	0	3	0	0	0	0	3	0	1	1
e. none of the above	0	3	3	1	6	9	3	6	3	3

ITEM	Physical Science 110 (n=37)		Earth Science 111 (n=84)		Biology 112 (n=24)		Biology 114 (n=34)		Composite (n=179)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	%		%		%		%		%	
5. When I complete/now that I have completed this course:										
a. I know a lot more useful information	57	37	36	36	32	21	46	33	42	34
b. I know a lot of facts	23	27	21	38	35	46	20	45	24	38
c. I learned some facts-none very useful to me	17	22	32	23	19	12	26	18	25	20
d. I only got a passing grade and satisfied a degree requirement	0	3	4	0	7	0	5	0	4	1
e. none of the above	3	11	7	3	7	21	3	3	5	7
6. Most people do not appreciate the importance of science:										
a. strongly agree	19	8	16	12	23	8	17	11	18	11
b. agree	55	73	63	59	64	75	57	65	60	65
c. undecided	23	11	15	19	13	17	20	15	18	16
d. disagree	3	5	6	10	0	0	3	9	3	7
e. strongly disagree	0	3	0	0	0	0	3	0	1	1
7. If possible, I'd like to take another science course in college:										
a. strongly agree	6	20	8	22	19	29	14	18	10	21
b. agree	26	20	19	26	35	42	26	24	24	26
c. undecided	49	34	52	25	23	12	40	26	45	26
d. disagree	15	21	14	20	13	12	11	29	14	21
e. strongly disagree	4	5	7	7	10	5	9	3	7	6
8. The benefits of science clearly outweigh any harm:										
a. strongly agree	28	22	21	30	43	25	41	29	29	27
b. agree	32	42	43	40	23	46	35	38	36	41
c. undecided	38	28	27	25	27	21	15	24	28	25
d. disagree	2	8	9	5	7	8	6	9	6	7
e. strongly disagree	0	0	0	0	0	0	3	0	1	0
9. My everyday experiences are made more meaningful through knowing science:										
a. strongly agree	15	16	14	14	35	12	9	12	17	14
b. agree	53	43	39	54	26	46	50	50	42	50
c. undecided	24	22	34	21	19	29	17	29	27	24
d. disagree	6	16	11	11	10	8	21	9	11	11
e. strongly disagree	2	3.	2	0	10	4	3	0	3	1

ITEM	Physical Science 110 (n=37)		Earth Science 111 (n=84)		Biology 112 (n=24)		Biology 114 (n=34)		Composite (n=179)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
	%		%		%		%		%	
10. I try to take the time to watch science TV programs:										
a. strongly agree	8	5	10	13	23	4	17	9	13	9
b. agree	28	22	27	26	16	41	26	29	25	28
c. undecided	15	16	24	17	23	17	17	24	21	18
d. disagree	43	43	28	31	19	38	23	32	29	35
e. strongly disagree	6	14	11	13	19	0	17	6	12	10
11. There are quite a few things in science I wish to find out about:										
a. strongly agree	30	28	29	26	39	33	29	29	31	28
b. agree	49	47	44	44	39	50	38	35	43	44
c. undecided	19	14	17	20	10	17	27	21	18	19
d. disagree	2	8	10	10	12	0	3	12	7	8
e. strongly disagree	0	3	0	0	0	0	3	3	1	1
12. What a person learns about science should be closely related to his personal experience:										
a. strongly agree	30	30	25	17	29	17	14	18	25	20
b. agree	47	40	39	47	42	54	46	35	43	44
c. undecided	19	16	21	24	19	21	23	24	21	22
d. disagree	4	11	14	12	7	8	14	23	10	13
e. strongly disagree	0	3	1	0	3	0	3	0	1	1
13. Because of this course, my attitude toward science has really improved:										
a. strongly agree		6		18		30		21		18
b. agree		44		45		37		35		42
c. undecided		31		32		33		29		31
d. disagree		19		5		0		12		8
e. strongly disagree		0		0		0		3		1

APPENDIX VII

PART III: OPEN-ENDED QUESTIONS

APPENDIX VII

Part III: Open-Ended Question

1. When you originally selected this science class from other possible classes, you probably had some reasons for doing so. Below you will find a list of 7 possible factors which may have influenced your decision. Choose the three most influential factors and rate them 1 - most important, 2 - next important, 3 - next most important.

Factor		Physical Science 110	Earth Science 111	Biology 112	Biology 114	Composite	Counselors
a. previous high school experience	1	9	5	33	11	11	43
	2	38	13	17	28	22	29
	3	22	14	28	16	18	29
b. previous college experience	1	0	1	0	5	1	0
	2	0	1	0	6	2	0
	3	5	0	0	12	3	0
c. this is the best of the college science classes offered	1	4	8	6	19	9	0
	2	6	16	0	4	10	14
	3	18	9	11	4	10	0
d. this is the easiest of the college classes offered	1	4	13	6	0	8	14
	2	9	18	17	9	14	14
	3	6	15	11	12	12	29
e. I expected the other college science classes to be worse than this one	1	18	22	6	9	17	0
	2	6	20	17	16	15	0
	3	18	26	11	22	23	14
f. this course is required for my choice of career	1	31	17	38	31	25	29
	2	13	12	11	6	11	43
	3	18	14	17	25	17	0
g. I have a general interest in this subject	1	34	34	11	25	29	14
	2	28	20	38	31	26	0
	3	13	22	22	9	17	28

*Numbers given in table refer to % of population responding. Thus, the first row, first column entry (9) indiciates that 9% of students surveyed in Physical Science 110 rated "previous high school experience" as a "most important factor" in their decision to enroll.